

Association of Depression and Excessive Daytime Sleepiness among Undergraduate Dental College Students in Chennai, India

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ABSTRACT

Introduction: Excessive daytime sleepiness (EDS) has become an emerging problem in 50% of college students. For healthcare students and professionals, the negative impact of EDS not only negatively affects the individual but also the safety and quality of care to the patients. The aim of the study was to investigate the prevalence of EDS among the dental students and to examine the correlation between risk factors and EDS in college students.

Materials and methods: An online questionnaire (Google Form) with questions related to the sociodemographic characteristics, daytime sleepiness, depression, insomnia, and sedentary behaviors was distributed via online platforms. Data were collected and analyzed using SPSS software. Bivariate analysis (Chi-square test) was used to assess the association between independent variables with each of the main outcomes of interest. Independent *t*-test was done to compare continuous variables of interest between those with EDS and without EDS. Pearson correlation test was used to analyze the correlation between the variables.

Results: A total of 170 students participated in the survey. The overall EDS prevalence was 72.4%. About 37.6% and 27% said they experience insomnia and had severe depression. There was a positive correlation between CESS score (EDS), depression, and insomnia score.

Conclusion: Daytime sleepiness was highly prevalent among the college students in this study, and it was significantly associated with depression and insomnia among the college students.

Keywords: Dental students, Depression, Excessive daytime sleepiness, Insomnia, Sleep quality.

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INTRODUCTION

Dentistry is a multifaceted health profession that requires academic, clinical, and soft skills during the learning period. The curriculum of dental education requires enormous technical skill and pitches the students against a stressful learning environment.¹ According to the survey done by Schmitter et al., stress encountered during dental education is more pronounced than during medical education.²

Stress faced by dental students is from multiple sources and has a considerable negative impact on their performance. A systematic review by Alzahem et al. listed the different major stressors reported in majority of the studies included in the review: (i) Living accommodation factors, (ii) Personal factors, (iii) Educational environment factors, (iv) Academic factors, and (v) Clinical factors.³ According to Cooper's theory, stress may cause symptoms of mental illness such as anxiety, depression, and somatic complaints, which may act as stressors.⁴

Depression and anxiety are the most common psychological disorders frequently noticed among dentists.^{5,6} Depression is an emotional state that ranges from sadness to suicidal state.⁷ Sabbarwal et al. reported that the prevalence of depression among Indian dental students was 49%.⁸ Depressive symptoms among dental students can be attributed to having a heavy studying schedule and the necessity to gain a large amount of information and clinical skill in a short period of time.⁹

Any alterations in the mental well-being of an individual such as depression and anxiety may have a negative impact on the sleep routine. Pagnin et al. found that emotional exhaustion and daytime sleepiness showed an important mutual influence.¹⁰ A normal

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person needs approximately 8 hours of sleep every night to perform daily activities efficiently and maintain good health.¹¹ Reimann and Voderholzer stated that adequate sleep is correlated with both normal physical and psychological functioning of the individual, thus enhancing the individual's learning skills.¹² Sleep disturbances may promote the onset of burnout and mental disorders because they compromise the restorative function of sleep.¹³

Excessive daytime sleepiness has become an emerging problem, found in 50% of college students compared with 36% of adolescence and adults.¹⁴ Excessive daytime sleepiness is a sign of inadequate sleep, whether due to sleep restriction/deprivation, or due to medical or psychiatric illness.¹⁵ Excessive daytime sleepiness is linked with hazard of workplace injuries¹⁶ and poor academic performance.¹⁷⁻²⁰ For healthcare students and professionals, the negative impact of EDS would not only negatively affect the

individual but could also affect the safety and quality of care to the patients.

For this reason, extensive research has been conducted to study EDS among medical students. However, only one study has been conducted on the subject among dental students,²¹ and there has been no study done among Indian dental students. The significance of the impact of EDS on the wellbeing of dental students warrants a survey. Therefore, the aim of this study was to (i) Investigate the prevalence of EDS among the dental students and (ii) Examine the correlation between risk factors (such as depression, insomnia, sedentary behaviors, smoking, and alcohol consumption) and EDS in college students.

MATERIALS AND METHODS

Ethical Approval

Ethical approval for this study was obtained from the Institutional Scientific Review Board.

Questionnaire

The questionnaire was adapted from previously published studies¹⁵ and pretested on a sample of 20 subjects to test the validity and reliability of the questionnaire. The responses of these participants were excluded from the main study. The final and validated version was developed. The questionnaire included five parts, the first part collected the demographic data of the study participants.

Chinese Epworth Sleepiness Scale (CESS)²²

This scale was developed in 1991 by Murray Johns and was used to assess the EDS. The scale included eight scenarios: sitting and reading, watching television, sitting inactive in a public place, being a passenger in a car for an hour without a break, lying down to rest in the afternoon when circumstances permit, sitting and talking to someone, sitting quietly after a lunch without alcohol, and in a car while stopped for a few minutes in traffic, to assess the extent and frequency of sleepiness. A rating of 0 (never sleep) to 3 (occasionally sleep) was given to each scenario for the likelihood to sleep.

Brief Symptom Rating Scale (BSRS-5)²³

This scale was used to assess the depression score and required participants to answer whether they have felt tensed, irritated, or had trouble falling asleep in the past week. Responses were rated on a scale of 0 to 4, with 0 being "not at all" and 4 being "extremely". Total scores ranged from 0 to 20, and were divided into four groups: "no symptoms" (0–5), "mild" (6–9), "moderate" (10–14), and "severe" (over 15).

Athens Insomnia Scale²⁴

This questionnaire was used to assess the severity of insomnia. We included items 1–5 of the AIS (night-time symptoms), and scoring from 0 to 3 represents with 0 being "asymptomatic" to 3 being "severe symptoms".

Other Factors

Other sections of the questionnaire included questions related to sedentary behaviors (such as watching television, using a computer, and sleeping per day) and physical activity. The body mass index (BMI) of study participants was calculated from the height and weight of each student. Smoking and alcohol-drinking habits during the past half-year were also assessed.

Table 1: Distribution of study subjects

Variable	Categories	Mean/Number	SD/%
Age (mean, SD)		22.12	1.61
Gender	Male	63	37.1
	Female	107	62.9
Year of study	Third year	46	27.1
	Final year	40	23.5
	Interns	84	49.4
Smoking	Yes	17	10.0
	No	153	90
Alcohol	Yes	22	12.9
	No	148	87.1
Insomnia	Yes	64	37.6
	No	106	62.4
Hours of exercise, hours per week	1 hour	126	74.1
	2–3 hours	30	17.6
	>4 hours	14	8.2
Depression score	No symptoms	22	12.9
	Mild	50	29.4
	Moderate	52	30.6
	Severe	46	27.1

Study Population and Data Collection

Google form was utilized to collect the data using a link that was circulated via various social platforms such as WhatsApp, Facebook, and Instagram. The questionnaire was collected from December 01 2020 to January 15th 2021. Participation in the survey was taken as implied consent. Undergraduate dental students of third year, final year, and interns were selected as the study population. A total of about 170 participants participated in the survey.

Statistical Analysis

Responses were coded and entered into an SPSS database. Data were entered in Microsoft Excel spreadsheet and analyzed using SPSS software (version 21, IBM Corporation, Texas, USA). Descriptive statistics were conducted. Bivariate analysis (Chi-square test) was used to assess the association between the independent variables with each of the main outcomes of interest. Independent *t*-test was used to determine the difference in the mean BMI, mean hours spent on sedentary activities, and physical activity between those with and without EDS. Pearson correlation was used to test the association between the variables.

RESULTS

A total of 170 students were assessed. The mean age of the present study population was 22.12 ± 1.61 , and most of the study subjects were female (62.9%). The study population included students in the third, final year, and interns (27.1, 23.5, and 49.4%, respectively). Only 10 and 12.9% of the study subjects reported to have smoking and alcohol habits. About 37.6% and 27% said that they experience insomnia and had severe depression. Majority of the subjects exercised for 1 hour per week (Table 1).

Majority of the students with EDS reported not having a habit of smoking or alcohol consumption in the last 6 months ($p < 0.002$ and $p < 0.04$, respectively). Most students who reported as having moderate and severe depression (33.3 and 30.9%, respectively) had

Table 2: Association between EDS and independent variables

Variables	EDS prevalence				Total		Chi-square	p-value
	Without EDS		With EDS		N	%		
	N	%	N	%				
Gender								
Male	17	36.2	46	37.4	63	37.1	0.022	0.88
Female	30	63.8	77	62.6	107	62.9		
Year of study							0.185	0.91
Third year	13	27.7	33	26.8	46	27.1		
Final year	10	21.3	30	24.4	40	23.5		
Intern	24	51.1	60	48.8	84	49.4		
Smoking in last 6 months							9.178	0.002
Yes	10	21.3	7	5.7	17	10.0		
No	37	78.7	116	94.3	153	90.0		
Alcohol in last 6 months							4.006	0.04
Yes	10	21.3	12	9.8	22	12.9		
No	37	78.7	111	90.2	148	87.1		
Insomnia							0.909	0.34
Yes	15	31.9	49	39.8	64	37.6		
No	32	68.1	74	60.2	106	62.4		
Hours of exercise (hours/week)							0.625	0.73
1 hour	33	70.2	93	75.6	126	74.1		
2–3 hours	10	21.3	20	16.3	30	17.6		
>4 hours	4	8.5	10	8.1	14	8.2		
Depression							14.527	0.002
No symptoms	13	27.7	9	7.3	22	12.9		
Mild	15	31.9	35	28.5	50	29.4		
Moderate	11	23.4	41	33.3	52	30.6		
Severe	8	17.0	38	30.9	46	27.1		

Chi-square tests; *p*-value <0.05 considered statistically significant

EDS ($p < 0.002$). We found no association between gender, year of study, insomnia, hours of exercise, and EDS prevalence (Table 2).

The mean age of the male and female students was 22.34 ± 1.69 and 21.98 ± 1.54 years, respectively. There was no statistical difference in the mean age between male and female students ($p = 0.15$). By defining EDS as having CESS score over 9, the prevalence was found to be 72% (male–73%; female–72%) (Table 3).

No statistical difference was seen in mean BMI between the subjects with EDS and without EDS among males and females. A higher proportion of male students with EDS had smoking habits and drinking habits when compared with females. Among those with a depression score over 6, a higher percentage of EDS was noted in each subgroup (mild, moderate, and severe depression) compared with the no-depression group. Male students with EDS spent significantly more time sleeping than males without EDS on non-holidays ($p = 0.01$). No statistical significant differences were found for time spent on computer, insomnia condition, and physical activity between those with and without EDS in different genders (Table 3).

Table 4 highlights the correlation between CESS score, insomnia, depression scale scores and sedentary behaviors. Positive correlations were found between CESS and sedentary behaviors, which indicated that the higher the CESS score, more the time spent on watching TV, computer, and sleep on holidays and non-holidays ($p < 0.05$). We also found a significant correlation between depression score and various sedentary behaviors ($p < 0.05$).

There was a positive correlation between CESS score, depression, and insomnia score. Depression scores were also significantly associated with insomnia. However, no significant association was found between any of these scale scores with either BMI or age (Table 5).

DISCUSSION

The prevalence of EDS in the present study was 72%, this was similar to the findings of Angelin et al.²¹ in whose study 71.1% presented a poor sleep quality. Elagra et al.²⁵ reported that 35% of the study subjects described their sleep as bad or very bad. Other studies conducted among Indian dental students stated that 38.6% of dental students had a problem falling asleep.^{26,27} Higher EDS prevalence in our study may be explained by the fact that our study mainly targeted only clinical dental students. Studies have shown that the level of stress increases considerably with the commencing of clinical training.²⁸

In a review by Jahrami et al., the pooled prevalence of EDS among medical students was 34.6%. The raw prevalence estimates of EDS among medical students reported by individual studies ranged from approximately 11% to 63%.²⁹ Our findings were higher compared with another study conducted among nursing students in Taiwan, wherein a prevalence of EDS was 35%.³⁰ Schmitter et al. stated that stress encountered during dental education is more pronounced than during medical education.²

Table 3: Association between EDS and characteristics of male and female study subjects

Variables	Total (n = 170)					
	Without/With excessive daytime sleepiness (EDS) (n = 47/123, 27.6%/72.4%)					
	Males			Females		
	Without EDS	With EDS	p-value	Without EDS	With EDS	p-value
BMI (kg m ⁻²), mean (SD)	22.83 ± 2.89	23.15 ± 4.40	0.77	21.84 ± 2.83	22.76 ± 4.41	0.290
Smoking in recent half-year (n, %)						
Yes	7 (41.2)	6 (13.0)	0.014	3 (10)	1 (1.3)	0.002*
No	10 (58.8)	40 (87.0)		27 (90)	76 (98.7)	
Alcohol in recent half-year (n, %)						
Yes	6 (35.3)	9 (19.6)	0.19	4 (13.3)	3 (3.9)	0.076*
No	11 (64.7)	37 (80.4)		26 (86.7)	74 (96.1)	
Insomnia (n, %)						
Yes	6 (35.3)	22 (47.8)	0.37	9 (30)	27 (35.1)	0.34*
No	11 (64.7)	24 (52.2)		21 (70)	50 (64.9)	
Depression score (n, %)						
0–5 (normal)	5 (29.4)	1 (2.2)	0.003	8 (26.7)	8 (10.4)	0.10*
6–9 (mild)	5 (29.4)	12 (26.1)		10 (33.3)	23 (29.9)	
10–14 (moderate)	6 (35.3)	15 (32.6)		5 (16.7)	26 (33.8)	
≥15 (severe)	1 (5.9)	18 (39.1)		7 (23.3)	20 (26)	
Exercise frequency (time/week during last 3 months) (n, %)						
0	0 (0.0)	0 (0.0)	0.98	0 (0.0)	0 (0.0)	0.532*
1	10 (58.8)	28 (60.9)		23 (76.7)	65 (84.4)	
2–3	5 (29.4)	13 (28.3)		5 (16.7)	7 (9.1)	
≥4	2 (11.8)	5 (10.9)		2 (6.7)	5 (6.5)	
Sedentary activities [hours, mean (SD)]						
Watching TV						
Non-holiday	1.50 ± 1.67	1.49 ± 1.53	0.98	1.13 ± 1.25	1.20 ± 1.40	0.81
Holiday	1.59 ± 1.41	1.87 ± 1.54		1.52 ± 1.39	1.81 ± 1.51	
Computer (using Internet, playing games)						
Non-holiday	1.15 ± 1.20	1.54 ± 1.32	0.28	1.15 ± 0.99	0.99 ± 1.21	0.53
Holiday	1.47 ± 1.32	1.86 ± 1.50		1.03 ± 1.15	1.44 ± 1.48	
Sleep duration						
Non-holiday	1.24 ± 1.55	2.36 ± 1.59	0.01	2.47 ± 1.61	2.84 ± 1.63	0.28
Holiday	2.12 ± 1.60	2.84 ± 1.56		2.75 ± 1.66	3.33 ± 1.53	

*Chi-square test + Independent t-test; p-value <0.05 considered statistically significant

Sleep quantity, sleep quality, and sleep hygiene are important determinants of EDS and may have a dose–response relationship.³¹ In our study, 37.6% of them experienced insomnia, of which 33.6% were females and 44.4% were males. Aldrin et al. found similar findings and reported that 34.7% of their study subjects had acute insomnia and 36.6% of had chronic insomnia.³² A recent review stated that sleep duration and quality were found to be associated with the risk of EDS among medical students.²⁹

A higher section of our study population with EDS reported experiencing insomnia among both males and females. However, our findings with regard to the association between insomnia, EDS, and gender were not statistically significant. Similar to our study, Angelin et al. reported higher EDS among females without any statistical significance.²¹ In addition to the stress, in recent years, there is a marked increase in the night use of social media, which increases the number of poor sleepers.³³

It has been reported that dental students show depressive symptoms during their training, and they are more than the general

population, showing higher levels of depression.³⁴ The prevalence of depressive symptoms in our study was 87.1%, of which 29.4%, 30.6%, and 27.1% of our study subjects came under the category of mild, moderate, and severe depression, respectively. Our findings were much higher when compared with other studies done among Indian and international dental students.^{8,35–37} The high percentage in our study could be attributed to the inclusion of only clinical-year students in this study, while some other studies included the non-clinical-year students as well.

We also found that males with EDS had a higher prevalence of depression as opposed to those without EDS ($p = 0.003$). However, this finding was not found to be significant among female students. Regardless of gender, more number of students with EDS reported experiencing depression. Other studies also found an association between depression/psychological distress and EDS/sleep.^{38–41} Like a previous survey,³⁷ the male students in this study reported experiencing more depression (higher BSRS score and prevalence of depression) than female students, this finding

Table 4: Correlation between CESS, insomnia, depression scale scores and sedentary behaviors

Variables	Test statistic	TV holiday	Computer holiday	Sleep holiday	TV non-holiday	Computer non-holiday	Sleep non-holiday
CESS score	r coefficient	0.177*	0.247**	0.205**	0.138	0.091	0.176*
	p-value	0.021	0.001	0.007	0.072	0.239	0.021
	N	170	170	170	170	170	170
Insomnia score	r coefficient	0.028	0.051	0.036	0.189*	0.046	-0.084
	p-value	0.715	0.512	0.642	0.013	0.554	0.274
	N	170	170	170	170	170	170
Depression score	r coefficient	0.097	0.233**	0.240**	0.168*	0.185*	0.107
	p-value	0.207	0.002	0.002	0.029	0.016	0.166
	N	170	170	170	170	170	170

Pearson correlation test; *p-value <0.05, ** p-value <0.005 considered statistically significant

Table 5: Correlation between scale scores, age, and BMI

Variables	Insomnia score	Depression score	BMI	Age	
CESS score	r coefficient	0.235**	0.325**	0.039	-0.040
	p-value	0.002	0.000	0.610	0.609
	N	170	170	170	170
Insomnia score	r coefficient		0.501**	0.067	0.052
	p-value		0.000	0.383	0.501
	N		170	170	170
Depression score	r coefficient		-0.084	-0.085	
	p-value		0.278	0.273	
	N		170	170	

Pearson correlation test; **p-value <0.005

was not statistically significant. Our study findings were dissimilar to other studies where the females were more depressed than the males.^{8,9,42,43} The difference in our findings could be attributed to the equal treatment of both genders in the learning environment. Male and female students face many of the same challenges related to academic life, thus, the shared experience may result in similar psychological responses.³⁷

Owing to the stress of the demanding academic environment, university students experience disturbances in their circadian cycle, which is further compounded by sleep-negative habits such as browsing the internet, watching television, and live-streaming shows and the use of alcohol, tobacco, and recreational drugs.^{44,45} In the present study, a higher proportion of male students with EDS had smoking habit and drinking habits when compared with females. Previous literature reported that EDS risk was higher in male students with a smoking habit or alcohol consumption.⁴⁰ Sleep disturbances can be caused by a nicotine effect in smokers, thereby affecting sleep quality and resulting in EDS.¹⁵ We find it important to state that stigma related to smoking and consumption of alcohol may have resulted in socially desirable responses from the students.

We assessed the time spent on sedentary activities such as sleeping, watching TV, and computer on holidays and non-holidays. Several studies found a significant association between EDS and time spent on the computer, internet, and watching TV.^{15,46,47}

According to a South Korean study among high school students, the odds of EDS were 5.2-fold greater in internet addicts and 1.9-fold greater in possible internet addicts compared with non-addicts.⁴⁷ Another study showed the negative impact of computer use among college students.⁴⁸ The mean hours spent sleeping on a non-holiday were higher among males with EDS than those without EDS ($p < 0.01$). However, we found no effect of sedentary activities and the prevalence of EDS among females.

On further analysis, regardless of EDS prevalence, we found significant correlations between the CESS score and the mean hours spent on watching TV and computer on holidays ($p < 0.05$). The association between time spent on the computer during non-holidays and CESS score was reported by Tsou and Chang.¹⁵ We also found that the CESS score was positively correlated with the hours spent on sleeping on holidays and non-holidays. The mean hours spent on watching TV on a non-holiday were positively correlated with insomnia-scale scores. The sedentary activities such as using the computer on a holiday and non-holiday were significantly correlated with depression-scale scores ($p < 0.002$ and $p < 0.01$). Other sedentary activities such as sleeping on a holiday and watching TV on a non-holiday were positively correlated with depression-scale scores ($p < 0.01$). Male students with EDS spent significantly more time sleeping than males without EDS on non-holidays ($p = 0.01$).

Among our study subjects, moderate physical activity and BMI in the normal range were found in both genders with/without EDS. The effect of lifestyle practices such as exercise on BMI, and generally on physical and mental well-being, has been demonstrated in many studies. The studies in the past have established that sleep problems such as EDS predispose individuals to higher BMI and hence consequences such as metabolic disorders and diabetes.^{49,50} BMI has been mentioned in the literature as an independent factor for EDS.^{40,51} In our study, BMI did not influence EDS,¹⁵ nor was BMI significantly correlated with CESS score, depression-scale score, or insomnia score.

We would like to draw attention to the positive correlation we found between CESS score, insomnia-scale score, and depression-scale score ($p < 0.01$). Several factors influence the stress levels, associated depressive symptoms, and sleep disorders in dental students. The symptoms of psychological disorders (especially depression) have been linked to disturbances in brain neurotransmitters, thus interrupting nighttime sleep quality and increasing the risk of EDS.^{15,39,52} In a study conducted among insomnia sufferers, the prevalence of EDS was found to be 45.61%.⁵³ However, a recent systematic review showed that the association

between EDS and sleep duration or sleep quality is more complex and is facilitated by other factors.²⁹

Previous studies in India have reported on sleeping disorders. To the best of our knowledge, this study is the first to report EDS among dental students. The findings of this study suggest that the dental undergraduate students are prone to EDS which was correlated with depression and insomnia. If not properly handled, EDS could lead to poor academic performance among students.^{19,20}

Limitations

This study has several limitations. First, this study followed a cross-sectional study design. Therefore, causal inferences may not be established. The small and convenient sample size of our study population is another limitation. Therefore, this sample may not be representative of and thus generalizable to all dental students in India. Nevertheless, the present article is representative for the population studied, offering original and important evidence on depression and EDS among undergraduate students in dentistry.

Second, compared with face-to-face interviews, self-reporting has limitations, including multiple biases. Third, each student was asked to recall the length of sleep time without the actual objective measurements, which could result in over- or underestimations. The sleep-quality tests were also not further analyzed in detail. However, our research remained one of the few studies investigating EDS among undergraduate dental college students and reported the correlation between EDS, depression, insomnia, and time spent on sedentary activities. The result from this study should be of value to future research studies in this field.

Future Scope

Intervention studies, larger multicenter and longitudinal studies are needed to further explore the causes of EDS and preventive measures to improve EDS in college students.

CONCLUSION

Based on the findings and within the limitations of our study, we conclude that EDS was highly prevalent among the undergraduate dental students. Excessive daytime sleepiness was significantly correlated with depression and insomnia. Possible intervention areas should be recognized and dental students should be educated about the importance of sleep and its impact on the well-being of the individual. We recommend that universities should provide guidance, counseling services, and raise awareness on how to deal with the competitive learning environment to help improve sleep behaviors and reduce the associated psychopathologies.

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